Daisy Wheel Printer II B

Radio Shack®

TRS-80
MICRO
COMPUTER
SYSTEM

26-1158 B
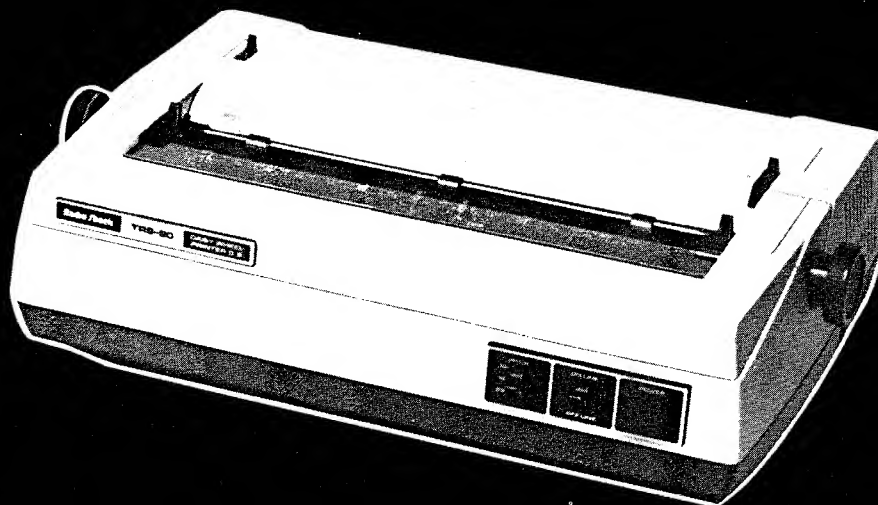
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The Daisy Wheel Printer II B is a letter-quality, reliable impact printer, designed for use with Radio Shack's TRS-80 Computers.
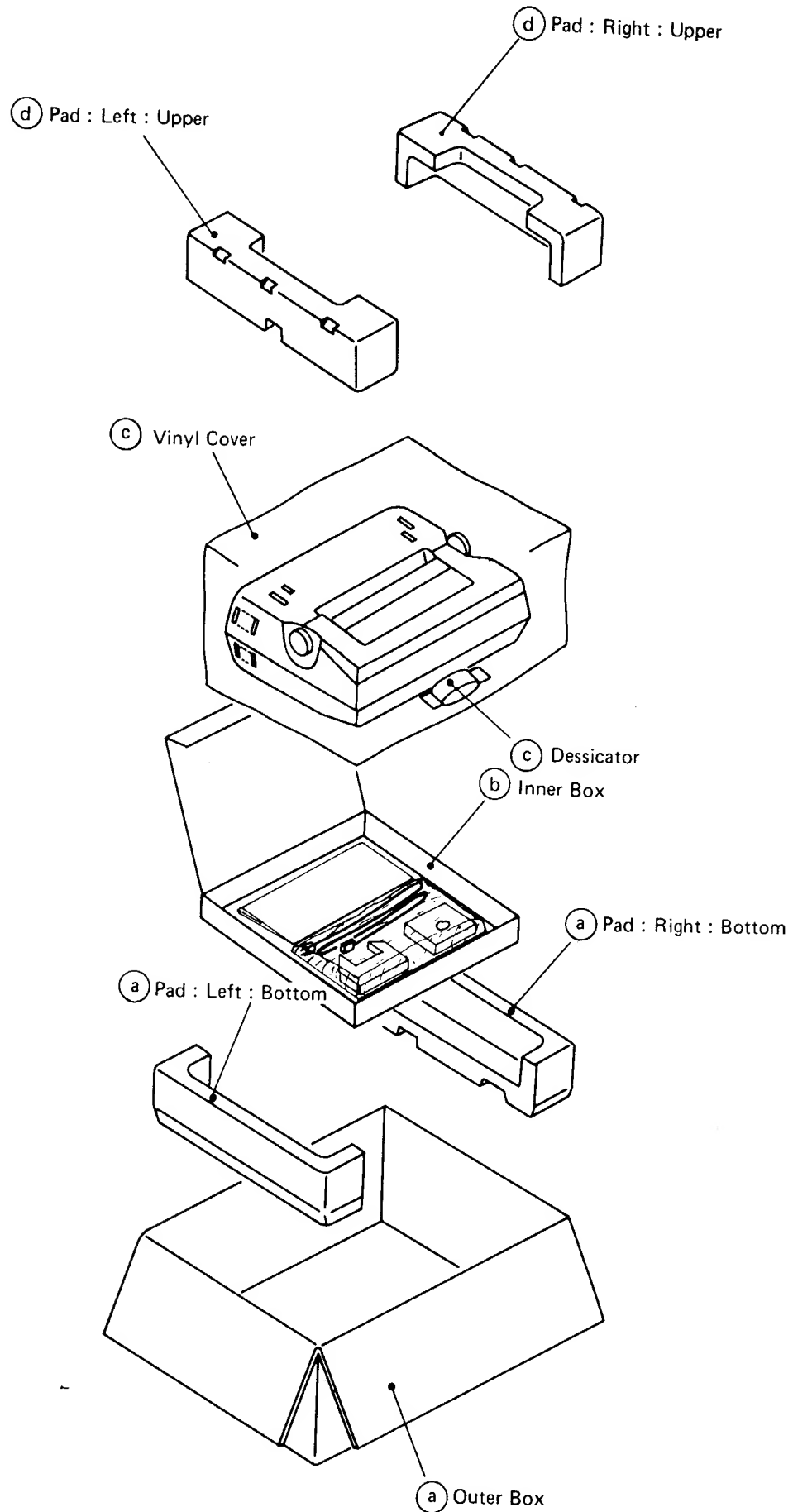
Exceptional features include:

- One-touch attachable/detachable "daisy" wheels
- Upper and lower case characters
- Switch selectable print densities (10 or 12 characters per inch). Also software selectable
- Up to 163 characters per line
- Cover interlock switch automatically stops printer if cover is opened (or not secure)
- Automatic ribbon-out sensor automatically stops printer when ribbon ends (with no loss of program of print information)
- Built-in optimizer automatically increases throughout when printing tabular material and forms by eliminating time intervals normally required for blank spaces
- Print head safety logic automatically stops print head if it encounters obstacles, thus protecting operator and/or printer from damage
- Accepts paper widths up to 15"
- Friction-feed mechanism
- Switch selectable print impression
- Proportional print space and mono-space modes
- Handles single or multi-copy (up to 6 sheets)
- Paper thickness adjustment
- Reverse tab/line-feed possible via software
- Half-line feed possible
- Self Test
- Auto new line function
- Comes supplied with Courier 10 font. Prestige Elite and Madeleine P.S. (Proportional Spacing) fonts are available (Details are on page 22).
- External Programming Mode available for special fonts.

Read this Manual carefully to utilize your Printer to its full capability.

NOTE :   We strongly recommend that you keep the surface of the printer clean (non-greasy and non-dusty). A very slick surface may result in the printer "slipping" during print operation.

PACKING ILLUSTRATION

ⓓ Pad : Right : Upper

ⓓ Pad : Left : Upper

ⓒ Vinyl Cover

ⓒ Dessicator

ⓑ Inner Box

ⓐ Pad : Right : Bottom

ⓐ Pad : Left : Bottom

ⓐ Outer Box

I. UNPACKING

The Packing Illustration on the facing page shows the complete packing assembly. Carefully remove the Printer from the box.
Take care not to throw away any accessories. Save all packing materials in case you need to ship the Printer.

The following accessory parts will be in the box:

One Print Wheel (in a Case)
One Multistrike Ribbon Cartridge (Black)
One Power Cable

II. PREPARING THE PRINTER

Location of Printer Mechanism Parts

Copy Control Lever   Character Scale   Paper Bail Lever

Platen Knob   Paper Release Lever

Front View Cover   Control Panel
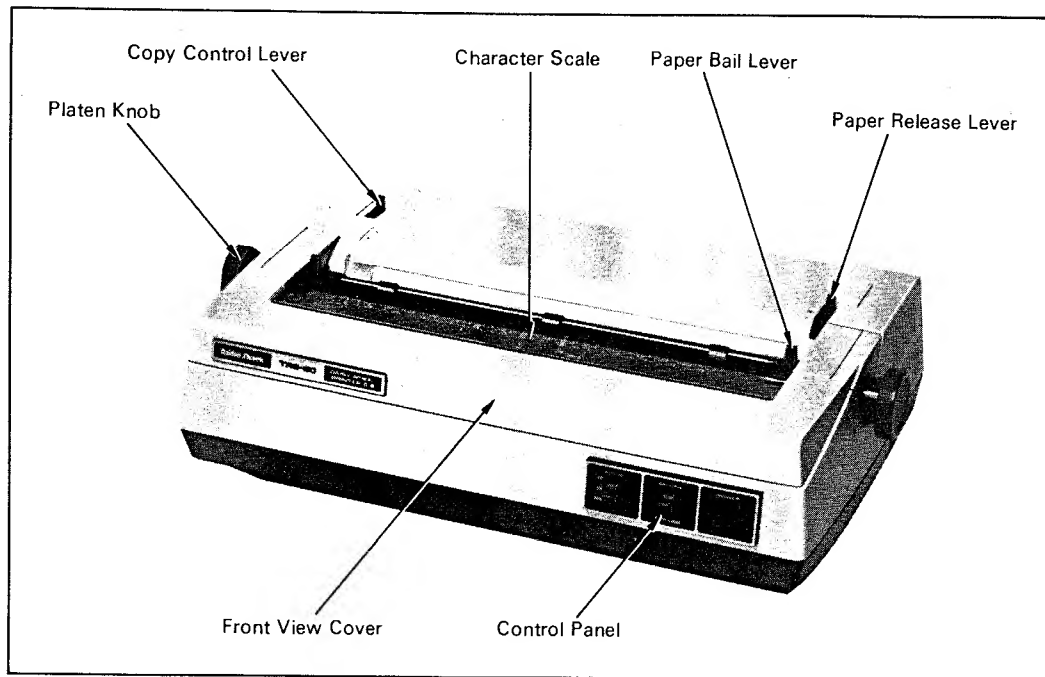
Unlocking the Printer Mechanism

1. Set the Printer on a desk and open the front view cover.

   Caution: Never open the printer's cover by lifting on the clear plastic window (front view cover).

Front View Cover
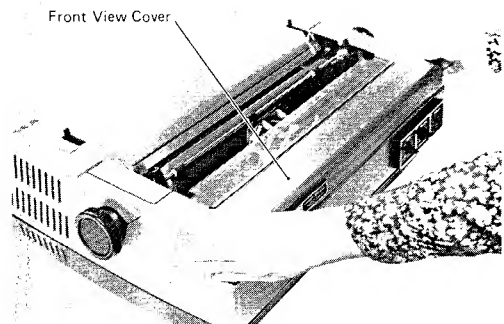
2. The carriage is protected by cushions on each side end.

   Remove cushion "A", slide the carriage to the left by hand and remove cushion "B".

   Then remove cushion "C" and two cushions "D".

   (Note: Keep these cushions in case you need to ship the Printer.)
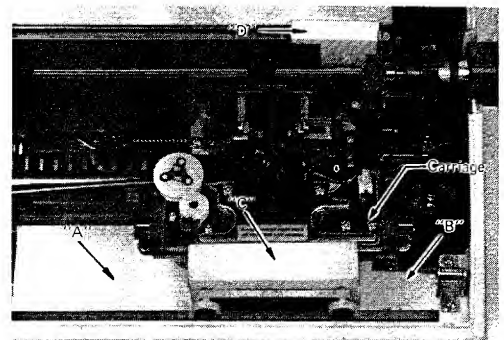
Installing and Removing Print Wheel

Installing Print Wheel

1. Lift up the carriage with the green Ribbon Guide.
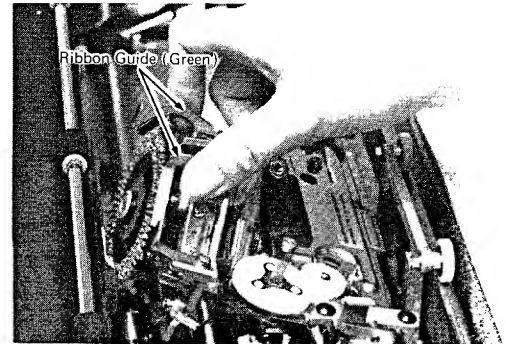
Ribbon Guide (Green)

2. Lift up the green wheel knob and fit the Print Wheel onto the Setter, making sure to match up the red marks.

Red mark

Rad mark

Print wheel

Setter
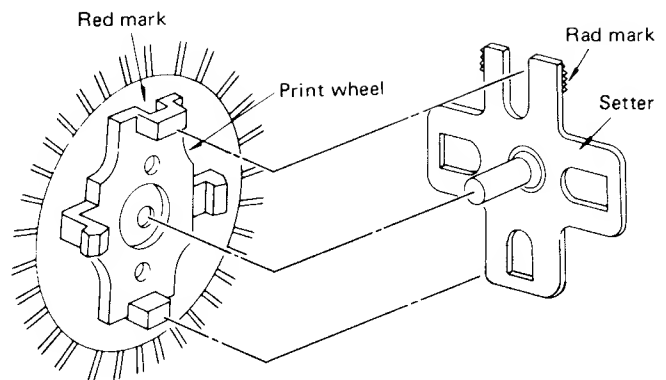
3. Press the Print Wheel to "click" into place. The green knob should be down.
   After properly setting the Print Wheel, push in the Ribbon Guide, use your fingers to hold the part shown in the photograph on the right.
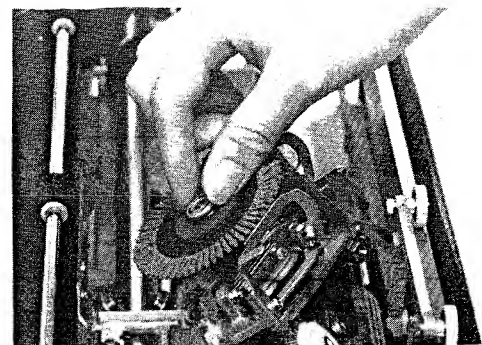
4. To Remove the Print Wheel

Pull up and lift off the Print Wheel while holding the green knob. Carefully store wheel in the print wheel case.

Note: Twist the wheel back and forth while pulling it up to make it lift off more easily.
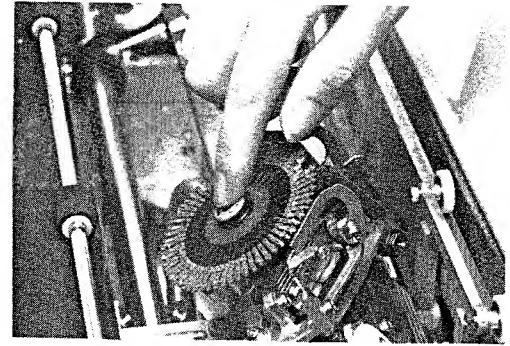
Installing and Removing Ribbon Cartridge

1. Remove slack in the ribbon by turning knob on the Ribbon Cartridge. Insert the ribbon between the Ribbon Guide and the card holder.
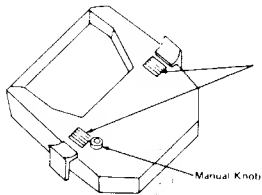
Press these parts to make the Ribbon Cartridge tabs hold the Cartridge.
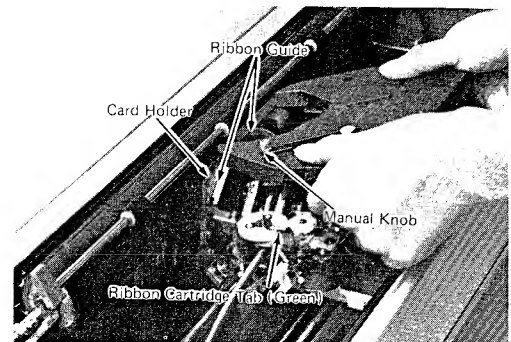
2. Make sure the ribbon cartridge is properly secured. Turn the ribbon feed gear 1/4 — 1/2 turn until the ribbon clicks down.
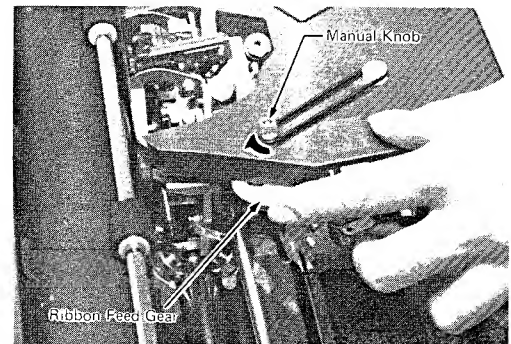
3. To remove a Ribbon Cartridge, tilt the upper stopper to the left and open the ribbon cartridge tabs slightly to the outside and you can easily lift up the ribbon.
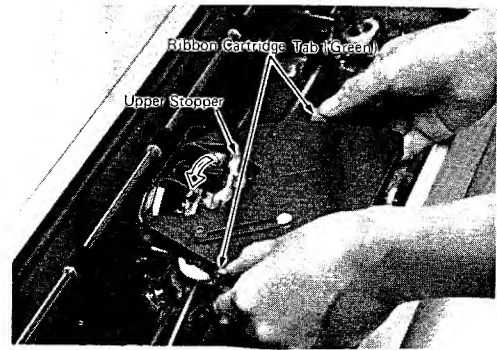
III. OPERATING THE PRINTER

Loading Paper

1. Release the Paper Bail Lever from the Platen by pulling forward.
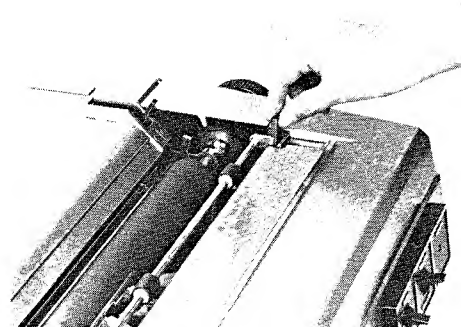
2. Insert paper down behind the Platen, and roll the Platen by hand to bring the paper around the platen and up in front.
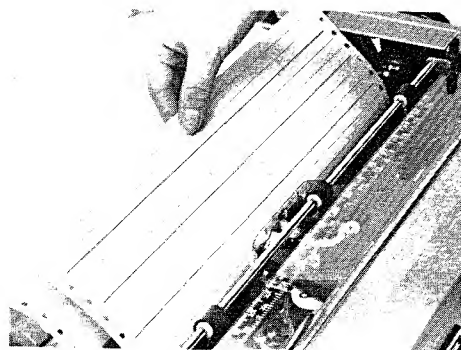
3. Pull the Paper Release Lever forward to release platen pressure to aid in proper paper alignment.
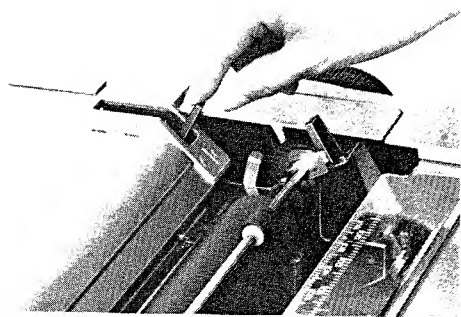
4. Align and position the paper at the left hand margin.
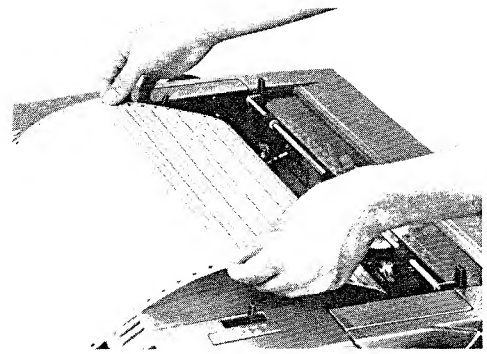
5. While holding the paper in the proper position, return the Paper Release Lever to its operating position.
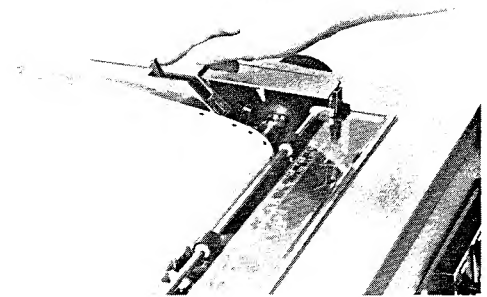
6. Return the Paper Bail Lever to its operating position to apply platen pressure on the paper.
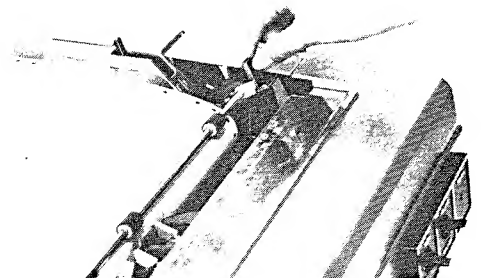
7. While pushing the right hand platen knob, roll the platen to position paper precisely for printing.

Copy Control (Paper Thickness Adjustment)

The left copy control lever is for the type and thicknesses of paper to be printed. Four positions are provided on the copy control lever. This lever should be in the first position (fully forward) when printing single thicknesses of paper. As paper thickness increases, move the lever toward the rear.
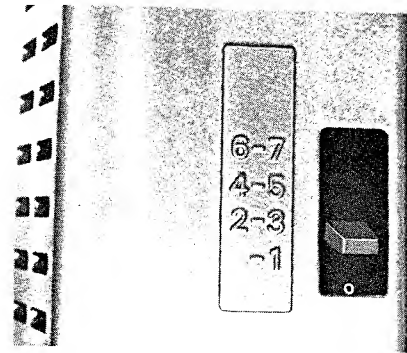
Impression Control (Print Intensity Adjustment)

The Impression Control Switch provides three levels of print intensity (hammer energy) to accommodate print wheel font variations as well as for multiple copy forms.

Level	Print Wheel Font
Low	Courier 10, Cubic 15, Light printing
Medium	Prestige Elite, Madeleine P.S., Tile Italic, Cubic P.S., OCR-B 10, Letter Gothic 12, Proportional Spacing
High	Heavy printing or multiple page forms
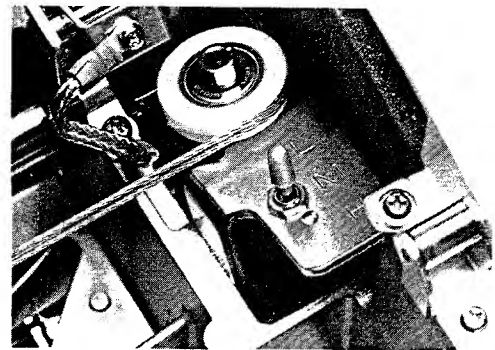
Cover Switch

A cover switch is on the front view cover. The printer will not operate if the front cover is opened. Be sure to close the cover before you operate the printer.

Card Holder Ruled Line

You can locate the printing position by using the ruled line (red) on the card holder. The photo shows the red line markings.

- 13 -
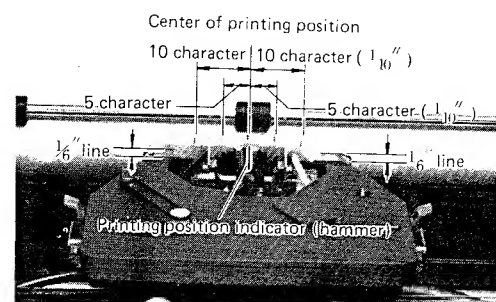
Connection and Self-Test

Plug the AC cord into the AC Connector on the back of the Printer. Plug the other end into a 3-prong, grounded AC outlet.

Before connecting the Printer to the Computer (or Interface), perform the Printer Self-Test.

1. Turn the Printer on. The power switch is located on the rear of the unit, just above the AC Connector.

   Note: Do not perform the Self-Test unless the Printer is loaded with full size paper. Otherwise characters will be printed on the platen.
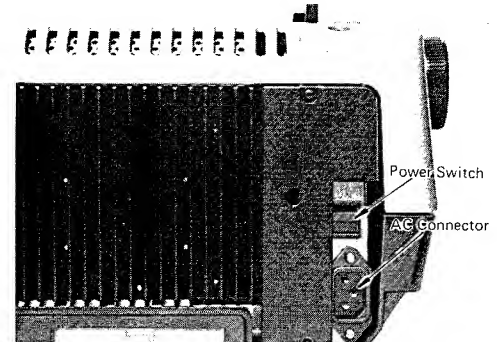
2. Set to OFF LINE on the control panel shown next page.

3. Press the TEST switch. It is on rear above the interface connector. The Printer should print a line of test characters.
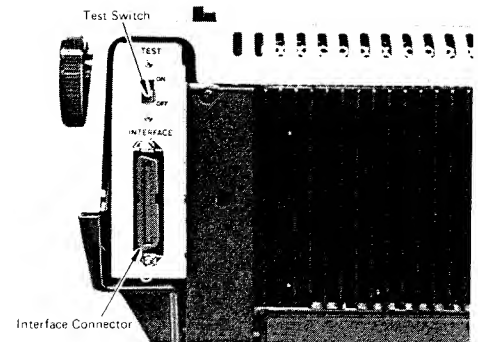
4. Adjust Copy Control and/or Impression Control for best printing quality.

5. Turn off the Printer.

Now you've finished the Self-Test. Connect the Interface Cable to the jack on the back of the Printer. Connect the other end to the TRS-80 system.

Other Controls and Indicator

POWER LED .... Lights up when the Printer is on.

ON LINE/OFF LINE .... Set to ON LINE to make the Printer ready to accept data from the Computer. Set to OFF LINE to stop receiving data from the Computer.

PITCH .... Selects the printing pitch. At 10 the pitch is set for 10 characters/inch (1/10"). At 12 the pitch is set for 12 characters/inch (1/12"). At PS the spacing is proportional to the space allotted for each character as it is printed (See pages 25, 26, 27).

When you use the Courierfont, use the 10 pitch setting. The Prestige Elite font should be used with 12 pitch. Madeline requires the PS (Proportional Spacing) position.

Caution: Do not accidentally bump pitch switch setting while running a program or operating the printer. Unless pitch has been selected/changed under software control, the pitch switch remains active. Once pitch has been changed via software, the pitch switch is no longer effective, to manually select pitch, the printer has to be turned off and then back on.
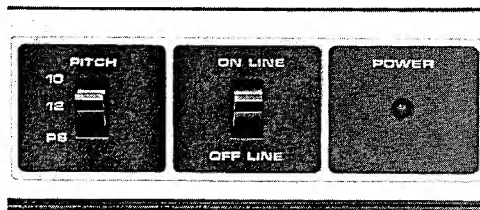
Warning: The "ribbon-out" sensor switch is inactive when the printer is off-line in a self-test mode. Thus, if the ribbon should run out while the printer is in this mode, the ribbon may break. If this should happen, turn off the printer and carefully replace the cartridge.

Notes regarding ribbon out error condition

When the printer is in a normal printing mode, if the ribbon runs out, the print head will stop. With a model I system, replace the ribbon, close the cover and the printer will resume printing without loss or insertion of data.

With a model II system, you will have to type continue (after replacing the ribbon) and then the printer will continue printing from the stopped head position. However, you should be aware that the entire current line will be restarted from this location, therefore there may be some printing duplication at this stopped line.

Front Cover Interlock

The front cover incorporates a special interlock switch - - if the cover is opened, the printer automatically will stop. When the cover is closed securely, the printer will continue to function as noted above under "Notes regarding ribbon out error condition".

Control Codes

According to the American Standard code for Information Interchange, there are 32 control codes in addition to the codes for the printable characters. (Control codes are sent as data, but the receiving device interprets them as abbreviated instructions, communication-status messages, etc.)

The Daisy Printer II B recognizes the following control codes and ignores any others.

Decimal	Code Octal	Hex	Function
08, n	010, n	08, n	Backspace n/120" (1 < n < 255)
10	012	0A	Line feed. [1]
13	015	0D	Carriage return with line feed [2]
14	016	0E	Disables underline printing
15	017	0F	Enables underline printing
27, 01	033, 001	1B, 01	1/120" space
27, 02	033, 002	1B, 02	2/120" space
27, 03	033, 003	1B, 03	3/120" space
27, 04	033, 004	1B, 04	4/120" space
27, 05	033, 005	1B, 05	5/120" space
27, 06	033, 006	1B, 06	6/120" space
27, 07	033, 007	1B, 07	7/120" space
27, 08	033, 010	1B, 08	8/120" space
27, 09	033, 011	1B, 09	9/120" space
27, 10	033, 012	1B, 0A	Reverse line feed. [1]
27, 14	033, 106	1B, 0E	1/12" space mode set
27, 15	033, 017	1B, 0F	1/10" space mode set
27, 17	033, 021	1B, 11	Proportional space mode set
27, 21	033, 025	1B, 15	Enables Carriage return only [2]
27, 22	033, 026	1B, 16	Disables Carriage return only [2]
27, 24	033, 030	1B, 18	Enters External program mode [3]
27, 25	033, 031	1B, 19	Exits External program mode [3]
27, 26	033, 032	1B, 1A	1/48" Line Feed
27, 28	033, 034	1B, 1C	Half line feed
27, 30	033, 036	1B, 1E	Reverse line feed (half)

*1 Line Feeds may be sent from Machine-Language Programs, but not from BASIC's LPRINT STATEMENT.   (In the model I TRS-80, memory address 14312 is a status/output port for the printer.   In the model III Z-80 port 251 is a status/output port for the printer.   For further information, see the Technical Documentation for the respective computer.)

*2 Normally code 13 (Hex 0D) causes Carriage Return + Line Feed.   However, after the code sequence of 27, 21 (1B, 15), input of 13 causes Carriage Return only ; 27, 22 (1B, 16) causes return to normal.

*3 Refer to "External Program Mode" on page 18.

EXAMPLES OF CODE PROGRAM LINES

LPRINT CHR$ (8) ; CHR$ (1)
    Backspace 1/120"
LPRINT CHR$ (13)
    Returns carriage with line feed
LPRINT CHR$ (15) "UNDERLINED" CHR$ (14) "NO UNDERLINE"
    Demonstrates underline function
LPRINT CHR$ (27);   CHR$ (3)
    Moves 3/120" space
LPRINT CHR$ (27);   CHR$ (14)
    All subsequent characters will be printed at 1/12" spacing.
LPRINT CHR$ (27);   CHR$ (17)
    All subsequent characters will be printed at proportional spacing.

Special Note: If you use this printer with a Model I TRS-80 and have BASIC programs which use top-of-form (I.E. programs for creating continuous form formats), you may require a special driver program.   This is available free of charge through your local Radio Shack store or Computer Center (special part number 700-2007).

(Without this special driver program your BASIC programs - - set up continuous forms - - may position improperly at the top of each new page of a form.)

External Program Mode

On some special wheels, such as OCR-B 10 and others, you need to "externally" control the following (the box of such wheel shows "Require Special Programming").
- Spacing between printed character (Proportional space mode only)
- Amount of ribbon feed
- Hammer impression level

(For ordinary fonts, these are controlled by the program in ROM.)
Each character or symbol requires a different amount of the three factors above.

First, you must enter External Program Mode by sending control codes 27, 24 (1B, 18). Then send a two-byte code for each character/symbol. The first byte is the ASCII code, the second byte contains the data specifying the printing format. Refer to the table on Page 19.
For example, capital letter "T" in OCR-B font requires 1/10" spacing, normal ribbon feed, and level 4 of hammer impression.
1/10" (= 6/60") is 0110.
Normal ribbon feed is 1.
Level 4 of hammer impression is 100.
Put together, we get 01101100, which is 108 is in decimal, 6C in hexadecimal.
By sending this data (108 or 6C), capital "T" is printed properly on OCR-B 10 font.
The code for each character/symbol is specified in the code chart provided with each wheel.
To return to normal mode, send code 27, 25 (1B, 19). When you turn the power switch off and then switch back on again, the Printer will be in the normal mode.

Programming example

To print "Tandy" on OCR-B 10 print wheel.

```
10 LPRINT CHR$ (27) CHR$ (24);      'ENTERS EXTERNAL PROGRAM MODE
20 LPRINT CHR$ (84) CHR$ (108);     'PRINT CAPITAL T
30 LPRINT CHR$ (97) CHR$ (107);     'PRINT LOWERCASE A
40 LPRINT CHR$ (110) CHR$ (107);    'PRINT LOWERCASE N
50 LPRINT CHR$ (100) CHR$ (108);    'PRINT LOWERCASE D
60 LPRINT CHR$ (121) CHR$ (107);    'PRINT LOWERCASE Y
```

Note: That first codes of each program line are ASCII codes for each character. Of course you can program each character inside quotation marks instead of sending code in ASCII. For example, line 10 can be 10 LPRINT "T" CHR$ (108);

D8	D7	D6	D5	D4	D3	D2	D1
PS unit set (Available in PS mode only)				RF set	Hammer set		

Unit amount (A/60")	D8	D7	D6	D5
0 (print without Carriage movement)	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
10	1	0	1	0
11	1	0	1	1
12	1	1	0	0
13	1	1	0	1
14	1	1	1	0
15	1	1	1	1

Hammer impression level	D3	D2	D1
0	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
(no hammer action)	1	1	1

Ribbon Feed amount	D4
Normal	1
Long	0

Special Functions

Auto NL (New Line)

In the following cases, the printer will automatically execute a new line function under the following conditions (carriage return with line feed):

1. In the 10 pitch mode, when the carriage moved over to the 136th position.

2. In the 12 pitch mode, when the carriage moves over to the 163rd position.

3. In the proportional spacing mode, when the carriage moves to within 8 units (8/60") from the right margin (right margin is 13.6" from the left margin).

Note: Auto NL may not execute at these exact positions (noted above) if the pitch has been changed during the execution of the current line.

Optimizer

To optimize printing time (more efficient carriage movement), when every a function code (SP, BSP, 1 unit to 6 unit SP, LF including NL, BLF, 1/2 LF and 1/2 BLF) is encountered in a program within 10 milliseconds of each other, the printer temporarily stores these codes until the following data is transferred:

1. Character codes are inputted.

2. Function codes are inputted with intervals of 10 msec or moe.

Then, these above stored function codes are executed at one time.   For example, when 10 LF codes are inputted with less than 10 msec intervals, the printer will automatically feed 10 lines at one time upon receipt of the next code (not one line feed, repeated ten times).

CARE OF YOUR PRINTER

Only the parts marked with green required any normal handling/adjustment. Any other maintenance should be performed only by a qualified service technician.

Of course you can and should perform standard cleaning procedures - - just as you would with any office typewriter. Clean the platen, printing wheel and other parts with standard typewriter cleaning fluids (use a soft, lint-free cloth).

Some do's and don'ts to assure maximum performance and reliability from your printer:

DO	DON'T
Plug power cord into 3-wire grounded outlet.	Operate printer in environments of high dust or dirt content, high temperature or humidity.
Position printer on a firm, clean, flat surface.	
Use only a lint-free cloth to clean printer case. Mild detergent solution can be used sparingly.	Place any objects on any part of printer (if anything falls inside the printer, turn printer, turn power off and carefully remove the object).
Ensure that all covers are closed and secured before operating.	
Turn off power before making any adjustment.	Use alcohol, solvents or harsh cleaning agents on any part of the printer.
	Operate printer without paper (if paper less than 15'' wide take care not to print lines too long for the paper).

TROUBLESHOOTING

If printer fails to operate properly, try to solve the problem as follows.

1. Power Lamp does not turn on
   A   Check if the AC cord is plugged securely to appropriate power source.

2. No communication with TRS-80
   A   Check if the interface cable is properly connected.
   B   Check LINE switch is ON.

3. Printer will not print
   A   Ensure that the front view cover interlocks.
   B   Check and change ribbon if necessary.
   C   Perform self test operation to insure printer is internally capable of printing   (See page 14).
   D   Ensure that the print wheel is locked into position.
   E   Check if anything has fallen into the mechanism that is physically obstructing the carriage movement.

SPECIFICATIONS

Printing Speed .... 43 characters per second

Carriage Return Speed .... 300ms per 13.6 inches

Line Feed Speed .... 4 inches per second

Printing Pitch .... 1/10 inch, 1/12 inch, Proportional spacing

Line Feed Pitch .... 1/6 inch, 1/12 inch

Font .... 124 character positions on Double Daisy Print Wheel

Wheel .... Courier 10 (Catalog Number 26-1420)
Prestige Elite (Catalog Number 26-1421)
Madeleine P.S. (Catalog Number 26-1422)
Cubic P.S. (Catalog Number 26-1425)
Tile Italic (Catalog Number 26-1426)
OCR-B 10 (Catalog Number 26-1484)
Letter Gothic 12 (Catalog Number 26-1485)
Cubic 15 (Catalog Number 26-1487)

Characters per Line .... 136 characters at 10 pitch mode
163 characters at 12 pitch mode

Impression Control .... Three levels available (See page 13):   H, M, L

Printwheel Life .... 40 million characters

Ribbon Life .... Nominal 270,000 character;   may vary according to the text printed
(Multistrike carbon ribbon)
Nominal 1,600,000 character (Fabric ribbon)

Interfaces
    Data .... 8 parallel data and 1 strobe
    Code .... Modified ASCII

Temperature Ranges
    Operating .... +4 to +95°F (+5 to +35°C)
    Storage .... −40 to 158°F (−40 to +70°C)

Relative Humidity
    Operating .... 20 – 90% RH   (No condensation)
    Storage .... 5 – 95% RH   (No condensation)

Paper
    Weight .... Total weight: 26 pound/ft² max. (127.9 grams/m² max.)
One ply: 8 pound/ft² max. (40 grms/m² max.)
    Size .... Width: 16 inches max. (420mm max.)
Length: 3.33 inches min. (84.7mm min.)

Ribbon .... Multi-strike, carbon ribbon (Catalog Number 26-1419)
Fabric ribbon (Catalog Number 26-1449)

Size .... 8.05" x 24.6" x 15.55"
204.5mm x 625mm x 395mm (HWD)

Power Requirements .... 120V AC, 50/60 Hz, 135W typical
220/240V AC, 50 Hz for European and
Australian models

Optional bi-directional tractor is available (Catalog Number 26-1447)
Optional uni-directional tractor is also available (Catalog Number 26-1446)

Interface
Input Signal

A. Input Signal System Diagram

```
                            DATA 1
                            DATA 2
                            DATA 3
  PRINTER                   DATA 4        TRS—80
                            DATA 5
                            DATA 6
                            DATA 7
                            DATA 8

                            STROBE
```

* Ground not shown.
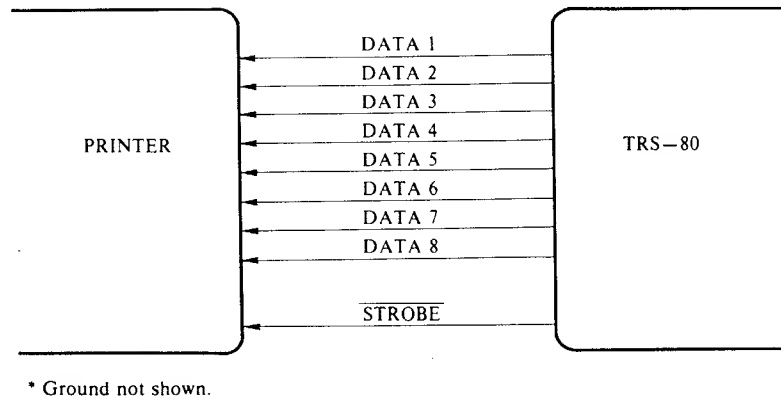
B. Description of Each Input Signal

(1) DATA LINES (DATA 1 ~ DATA 8)

8 inputs, to provide information for actuating the printer on these lines. The printer will ignore any invalid code applied.

(2) STROBE

Is a sampling signal for data lines, providing instruction signals for actuating the printer.

Output Signal

A. Output Signal System Diagram

```
                            BUSY
                         OUT OF PAPER
  PRINTER                   BUSY          TRS—80
                            ACK
                            FAULT
```

* Ground not shown.
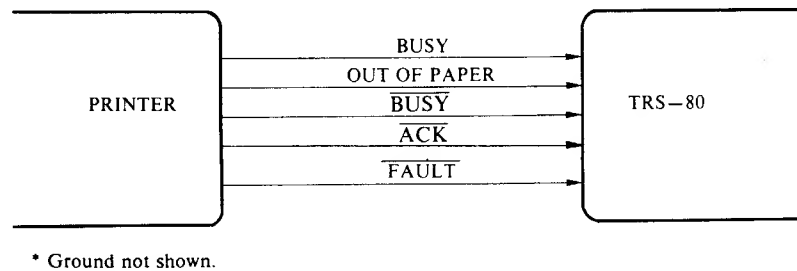
B. Description of each output signal

(1) BUSY

Busy condition:

1) Data is in buffer
2) Initial state
3) Off line mode

4) Error state
5) Ribbon fault state
6) Cover open state

Ready condition:
1) States other than above 1) to 6)
2) Cover close state

(2) OUT OF PAPER

No function.   This line is always "0" signal.

(3) $\overline{BUSY}$

This signal is the logical invers of BUSY.

(4) $\overline{ACK}$

This signal is indicates Printer is no longer busy.

(5) $\overline{FAULT}$

This signal indicates Printer is in error state, in ribbon fault state, in cover open state or in off line state.

Interface Signal Pin Assignments

pin 18   pin 1

pin 36   pin 19
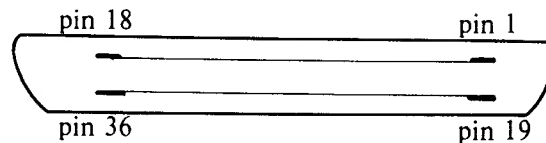
Pin	Signal Name	Pin	Signal Name
1	$\overline{STROBE}$	19	GND
2	DATA 1	20	GND
3	DATA 2	21	GND
4	DATA 3	22	GND
5	DATA 4	23	GND
6	DATA 5	24	GND
7	DATA 6	25	GND
8	DATA 7	26	GND
9	DATA 8	27	GND
10	$\overline{ACK}$	28	GND
11	BUSY	29	GND
12	OUT OF PAPER	30	GND
13	$\overline{BUSY}$	31	N.C
14	GND	32	$\overline{FAULT}$
15	GND	33	GND
16	GND	34	N.C
17	GND	35	N.C
18	+5 VDC	36	N.C

Note: • N.C. pins are actually pulled up to + 5 VDC through a 4.7K resistor.
• Pin 18 provides + 5 VDC to the TRS-80 (less than 80 mA of current).

Printable Characters

The Daisy Wheel Printer II B can produce all Modified ASCII characters. Here's what they look like:

Code			Char.	Code			Char.	Code			Char.	Code			Char.
Dec.	Hex	Oct.		Dec.	Hex	Oct.		Dec.	Hex	Oct.		Dec.	Hex	Oct.	
32	20	040	SP	64	40	100	@	96	60	140	`	128	80	200	à
33	21	041	!	65	41	101	A	97	61	141	a	156	9C	234	ç
34	22	042	"	66	42	102	B	98	62	142	b	163	A3	243	£
35	23	043	#	67	43	103	C	99	63	143	c	165	A5	245	μ
36	24	044	$	68	44	104	D	100	64	144	d	166	A6	246	°
37	25	045	%	69	45	105	E	101	65	145	e	167	A7	247	'
38	26	046	&	70	46	106	F	102	66	146	f	168	A8	250	†
39	27	047	'	71	47	107	G	103	67	147	g	169	A9	251	TM
40	28	050	(	72	48	110	H	104	68	150	h	170	AA	252	®
41	29	051	)	73	49	111	I	105	69	151	i	171	AB	253	©
42	2A	052	*	74	4A	112	J	106	6A	152	j	172	AC	254	1/4
43	2B	053	+	75	4B	113	K	107	6B	153	k	173	AD	255	3/4
44	2C	054	,	76	4C	114	L	108	6C	154	l	174	AE	256	1/2
45	2D	055	−	77	4D	115	M	109	6D	155	m	175	AF	257	¶
46	2E	056	.	78	4E	116	N	110	6E	156	n	187	BB	273	é
47	2F	057	/	79	4F	117	O	111	6F	157	o	188	BC	274	ù
48	30	060	0	80	50	120	P	112	70	160	p	189	BD	275	è
49	31	061	1	81	51	121	Q	113	71	161	q	190	BE	276	¨
50	32	062	2	82	52	122	R	114	72	162	r	191	BF	277	f
51	33	063	3	83	53	123	S	115	73	163	s	192	CO	300	§
52	34	064	4	84	54	124	T	116	74	164	t	204	CC	314	¥
53	35	065	5	85	55	125	U	117	75	165	u	219	DB	333	Ä
54	36	066	6	86	56	126	V	118	76	166	v	220	DC	334	Ö
55	37	067	7	87	57	127	W	119	77	167	w	221	DD	335	Ü
56	38	070	8	88	58	130	X	120	78	170	x	222	DE	336	¢
57	39	071	9	89	59	131	Y	121	79	171	y	223	DF	337	=
58	3A	072	:	90	5A	132	Z	122	7A	172	z	251	FB	373	ä
59	3B	073	;	91	5B	133	[	123	7B	173	{	252	FC	374	ö
60	3C	074	<	92	5C	134	\	124	7C	174			253	FD	375	ü
61	3D	075	=	93	5D	135	]	125	7D	175	}	254	FE	376	β
62	3E	076	>	94	5E	136	^	126	7E	176	~				
63	3F	077	?	95	5F	137	___	127	7F	177	(Blank)				

TABLE OF FONT POSITIONS ON PRINTWHEEL, IMPRESSION LEVELS AND PROPORTIONAL SPACE UNITS

A : FONT
B : POSITION ON PRINTWHEEL
C : IMPRESSION LEVEL
D : PROPORTIONAL SPACE UNIT

A			Z	Q	J	X	.	M	,	W	L	Y	A	I	H	F
B	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F
C			4	6	3	5	0	6	0	6	3	4	4	3	4	4
D			6	7	5	7	3	8	3	8	6	7	7	3	6	6

A	O	T	R	E	P	S	C	N	G	K	V	D	~	B	(	U
B	10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F
C	5	4	5	5	5	4	4	4	5	6	4	5	1	6	3	4
D	7	6	7	6	6	5	7	6	7	7	6	6	5	6	3	6

A	}	[	Ö	]	Ä	¨	3/4	TM	Ü	1/4	{	)	´	®	,,	1/2
B	20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F
C	3	3	6	3	5	0	5	4	5	5	3	3	0	5	2	5
D	3	3	7	3	7	5	5	5	6	5	3	3	5	6	4	5

A	^	`	©	═	=	#	ç	β	+	&	–	@	°	%	*	__
B	30	31	32	33	34	35	36	37	38	39	3A	3B	3C	3D	3E	3F
C	1	0	5	4	3	6	4	6	2	6	0	6	2	5	3	0
D	5	5	6	5	5	6	5	5	5	7	4	7	4	7	5	5

A	¶	/	z	q	j	x	:	m	;	w	ℓ	y	a	i	h	f
B	80	81	82	83	84	85	86	87	88	89	8A	8B	8C	8D	8E	8F
C	6	3	4	5	3	4	1	6	2	5	3	4	5	3	4	3
D	5	4	5	5	3	5	3	7	3	7	3	5	5	3	5	4

A	ō	t	e	r	p	s	c	n	g	k	v	d	ƒ	b	é	u
B	90	91	92	93	94	95	96	97	98	99	9A	9B	9C	9D	9E	9F
C	4	3	4	3	5	3	4	4	5	4	3	5	4	5	5	4
D	5	4	5	4	5	4	5	5	5	5	5	5	5	5	5	5

A	è	>	ö	<	ä	¢	à	†	ü	£	?	µ	¥	§	'	ù
B	A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	AA	AB	AC	AD	AE	AF
C	5	3	5	3	5	4	5	4	5	5	3	5	5	5	1	4
D	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	5

A	!	$	|		\	5	6	1	3	0	2	7	4	8	9	
B	B0	B1	B2	B3	B4	B5	B6	B7	B8	B9	BA	BB	BC	BD	BE	BF
C	2	6	3		3	4	5	3	4	4	4	4	5	4	5	
D	3	5	3		4	5	5	5	5	5	5	5	5	5	5	

Note: Space (ASCII 20 Hex) is 5 units in Proportional Space mode.

PROPORTIONAL CHARACTER SET UNITS PER COLUMN

3 UNITS	4 UNITS	5 UNITS		6 UNITS	7 UNITS	8 UNITS
. - 46/2E	" - 34/22	J - 74/4A	v - 118/76	Z - 90/5A	Q - 81/51	M - 77/4D
, - 44/2C	— - 45/2D	S - 83/53	d - 100/64	L - 76/4C	X - 88/58	W - 87/57
I - 73/49	° - 166/A6	~ - 126/7E	ƒ - 191/BF	H - 72/48	Y - 89/59	
(- 40/28	/ - 47/2F	¨ - 190/BE	b - 98/62	F - 70/46	A - 65/41	
} - 125/7D	f - 102/66	3/4 - 173/AD	é - 187/BB	T - 84/54	O - 79/4F	
[- 91/5B	t - 116/74	TM - 169/A9	u - 117/75	E - 69/45	R - 82/52	
] - 93/5D	r - 114/72	1/4 - 172/AC	è - 187/BB	P - 80/50	C - 67/43	
{ - 123/7B	s - 115/73	´ - 167/A7	> - 62/3E	N - 78/4E	G - 71/47	
) - 41/29	\ - 92/5C	1/2 - 174/AE	Ö - 220/DC	V - 86/56	K - 75/4B	
j - 106/6A		^ - 94/5E	< - 60/3C	D - 68/44	Ö - 220/DC	
: - 58/3A		` - 96/60	ä - 251/FB	B - 66/42	Ä - 219/DB	
; - 59/3B		≡ - 223/DF	¢ - 222/DE	U - 85/55	& - 38/26	
l - 108/6C		= - 61/3D	à - 128/80	Ü - 221/DD	@ - 64/40	
i - 105/69		ç - 156/9C	† - 168/A8	® - 170/AA	% - 37/25	
' - 39/27		β - 254/FE	ü - 253/FD	© - 171/AB	m - 109/6D	
! - 33/21		+ - 43/2B	£ - 163/A3	# - 35/23	w - 119/77	
I - 124/7C		* - 42/2A	? - 63/3F			
		— - 95/5F	µ - 165/A5			
		¶ - 175/AF	¥ - 204/CC			
		z - 122/7A	§ - 192/C0			
		q - 113/71	ù - 188/BC			
		x - 120/78	$ - 36/24			
		y - 121/79	5 - 53/35			
		a - 97/61	6 - 54/36			
		h - 104/68	1 - 49/31			
		o - 111/6F	3 - 51/33			
		e - 101/65	0 - 48/30			
		p - 112/70	2 - 50/32			
		c - 99/63	7 - 55/37			
		n - 110/6E	4 - 52/34			
		g - 103/67	8 - 56/38			
		k - 107/6B	9 - 57/39			

(Codes are in Decimal and Hexadecimal)

PROPORTIONAL CHARACTER STYLE CODE CHART

CODE	32/20	33/21	34/22	35/23	36/24	37/25	38/26	39/27	40/28	41/29
CHAR	SP	!	``	#	$	%	&	'	(	)
WIDTH	5	3	4	6	5	7	7	3	3	3
CODE	42/2A	43/2B	44/2C	45/2A	46/2E	47/2F	48/30	49/31	50/32	51/33
CHAR	*	+	,	—	.	/	0	1	2	3
WIDTH	5	5	3	4	3	4	5	5	5	5
CODE	52/34	53/35	54/36	55/37	56/38	57/39	58/3A	59/3B	60/3C	61/3D
CHAR	4	5	6	7	8	9	:	;	<	=
WIDTH	5	5	5	5	5	5	3	3	5	5
CODE	62/3E	63/3F	64/40	65/41	66/42	67/43	68/44	69/45	70/46	71/47
CHAR	>	?	@	A	B	C	D	E	F	G
WIDTH	5	5	7	7	6	7	6	6	6	7
CODE	72/48	73/49	74/4A	75/4B	76/4C	77/4D	78/4E	79/4F	80/50	81/51
CHAR	H	I	J	K	L	M	N	O	P	Q
WIDTH	6	3	5	7	6	8	6	7	6	7
CODE	82/52	83/53	84/54	85/55	86/56	87/57	88/58	89/59	90/5A	91/5B
CHAR	R	S	T	U	V	W	X	Y	Z	[
WIDTH	7	5	6	6	6	8	7	7	6	3
CODE	92/5C	93/5D	94/5E	95/5F	96/60	97/61	98/62	99/63	100/64	101/65
CHAR	\	]	^	—	`	a	b	c	d	e
WIDTH	4	3	5	5	5	5	5	5	5	5
CODE	102/66	103/67	104/68	105/69	106/6A	107/6B	108/6C	109/6D	110/6E	111/6F
CHAR	f	g	h	i	j	k	l	m	n	o
WIDTH	4	5	5	3	3	5	3	7	5	5
CODE	112/70	113/71	114/72	115/73	116/74	117/75	118/76	119/77	120/78	121/79
CHAR	p	q	r	s	t	u	v	w	x	y
WIDTH	5	5	4	4	4	5	5	7	5	5
CODE	122/7A	123/7B	124/7C	125/7D	126/7E	127/7F	128/80	156/9C	163/A3	165/A5
CHAR	z	{	|	}	~	Not used	à	ç	£	µ
WIDTH	5	3	3	3	5	-	5	5	5	5
CODE	166/A6	167/A7	168/A8	169/A9	170/AA	171/AB	172/AC	173/AD	174/AE	175/AF
CHAR	°	´	†	TM	®	©	1/4	3/4	1/2	¶
WIDTH	4	5	5	5	6	6	5	5	5	5
CODE	187/BB	188/BC	189/BD	190/BE	191/BF	192/CO	204/CC	219/DB	220/DC	221/DD
CHAR	é	ù	è	¨	ƒ	§	¥	Ä	Ö	Ü
WIDTH	5	5	5	5	5	5	5	7	7	6
CODE	222/DE	223/DF	251/FB	252/FC	253/FD	254/FE				
CHAR	¢	≡	ä	ö	ü	β				
WIDTH	5	5	5	5	5	5				

(Codes are in Decimal and Hexadecimal)

IMPORTANT INFORMATION

"This equipment generates and uses radio frequency energy and if not installed and used properly, that is, in strict accordance with the manufacturer's instructions, may cause interference to radio and television reception. It has been type tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- reorient the receiving antenna
- relocate the computer with respect to the receiver
- move the computer away from the receiver
- plug the computer into a different outlet so that computer and receiver are on different branch circuits.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet prepared by the Federal Communications Commission helpful:

"How to Identify and Resolve Radio-TV interference Problems". This booklet is available from the US Government Printing Office, Washington, D.C., 20402, Stock No. 004-000-00345-4."

MAIN CONTROL LOGIC 1/3

CN28 (CN1)

	6
+5V	5
ON LINE	4
PS SPACE	3
1/10 SPACE	2
GND	1

CN20 (CN2)

GND	3
GND	2
COVER OPEN SW	1

TP

CHECK OFF	
GND	

TP-2

OPT1	
GND	

CN26 (CN3)

TEST SW	3
GND	2
GND	1

LED

HUNCH
SP CHECK
SEL CHECK
POWER ON

CN6

45	LIFT HIGH			
43	LIFT HOLD	44	LF ØA	
41	SHIFT HIGH	42	LF ØB	
39	SHIFT LOWER	40	SP 1	
37	SP DRIVE	38	SP 2	
35	SP REVERSE	36	SP 3	
33	SP PT	34	SP HOME	
31	HAM DRIVE	32	SP CLOCK	
29	RESET	30	SEL&HAM1	
27	SEL DRIVE	28	SEL&HAM2	
25	SEL REVERSE	26	SEL&HAM3	
23	SEL PT	24	SLE HOME	
21	RIBBON END	22	SLE CLOCK	
19		20	RF ØA	
17		18	RF ØB	
15		16	RF DRIVE	
13		14	SP O	
11	GND	12	SERVO HOLD	
9	GND	10	+5V	
7	GND	8	+5V	
5	GND	6	+5V	
3	GND	4	+5V	
1	GND	2	+5V	

CN4

STROBE	1	GND	2
DATA 1	3	GND	4
DATA 2	5	GND	6
DATA 3	7	GND	8
DATA 4	9	GND	10
DATA 5	11	GND	12
DATA 6	13	GND	14
DATA 7	15	GND	16
DATA 8	17	GND	18
ACK	19	GND	20
BUSY	21	GND	22
OUT OF PAPER	23	GND	24
BUSY	25	NC	26
GND	27	FAULT	28
GND	29	GND	30
GND	31	NC	32
GND	33	NC	34
+5V DC	35	NC	36
GND	37	GND	38
GND	39	RESTORE	40

CN5
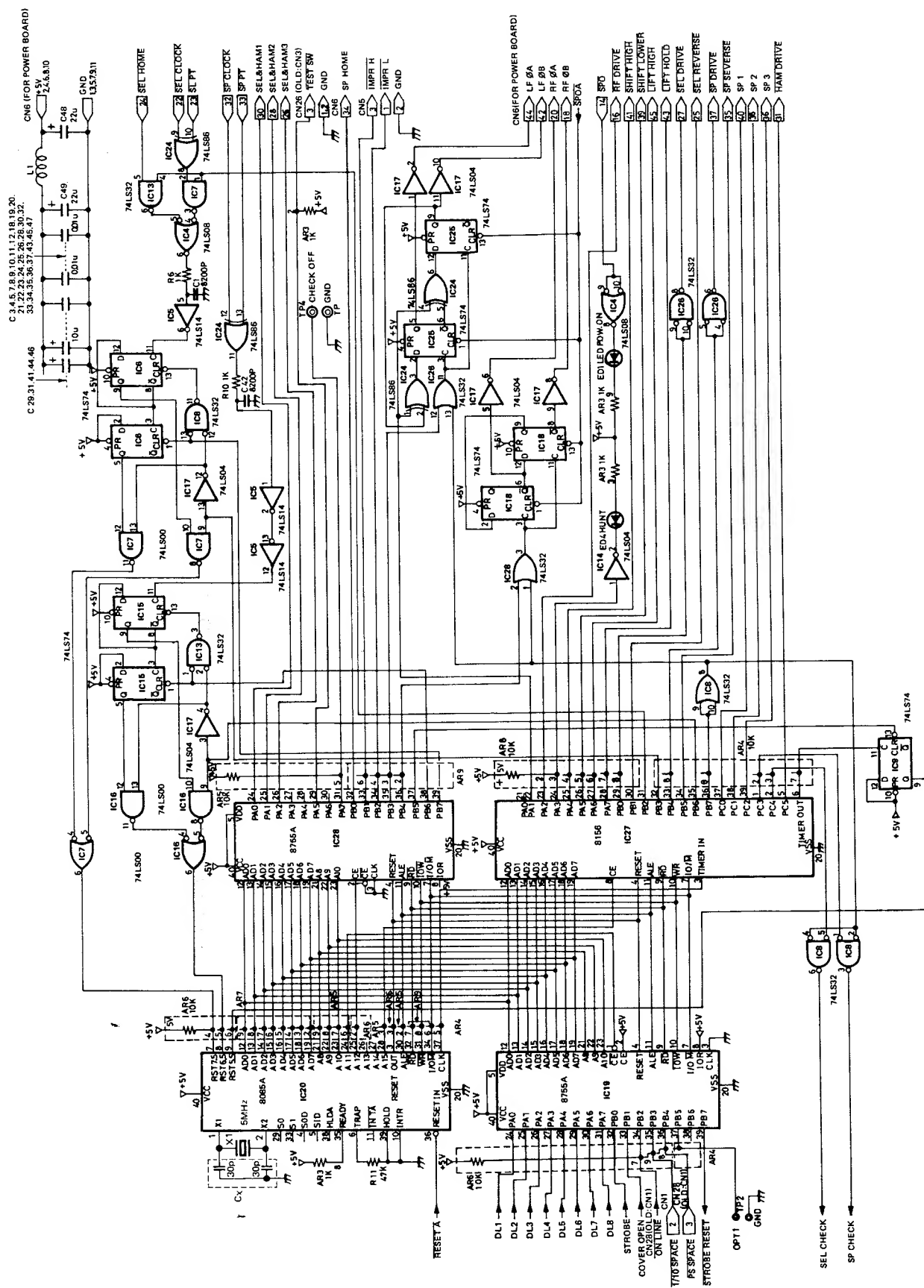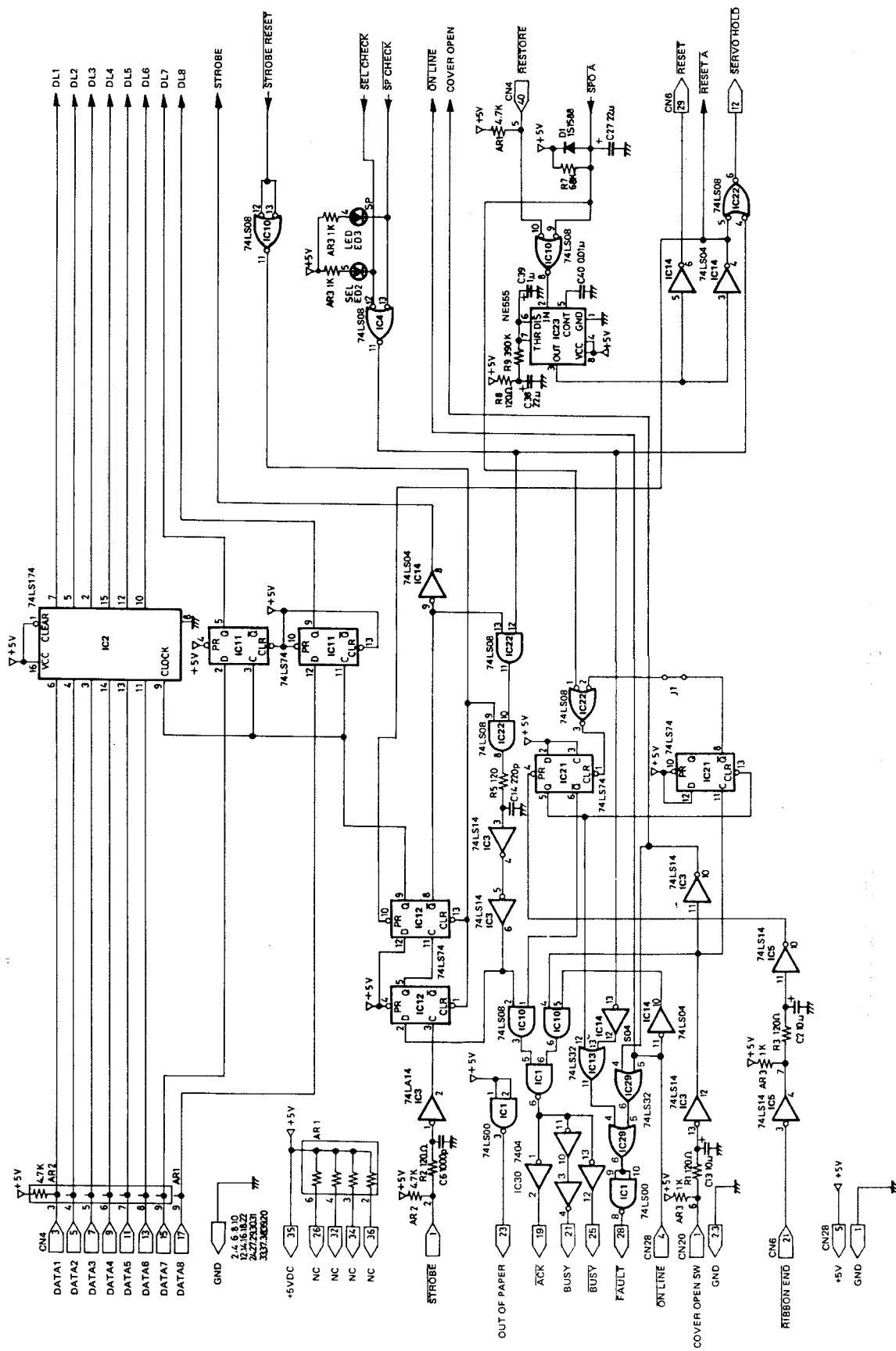
IMPR L	GND	IMPR H
1	2	3
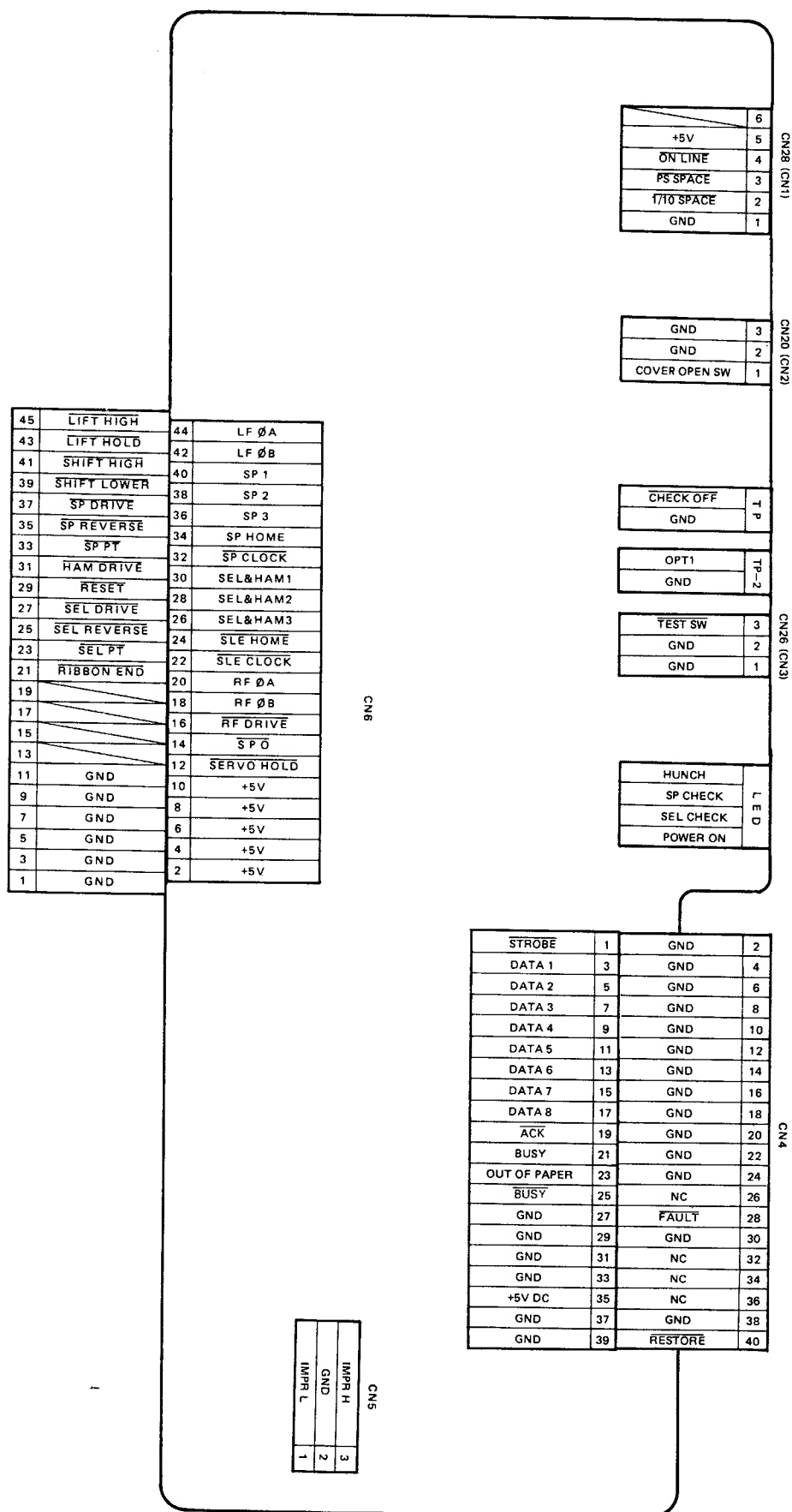
POWER BOARD LOGIC 1/6
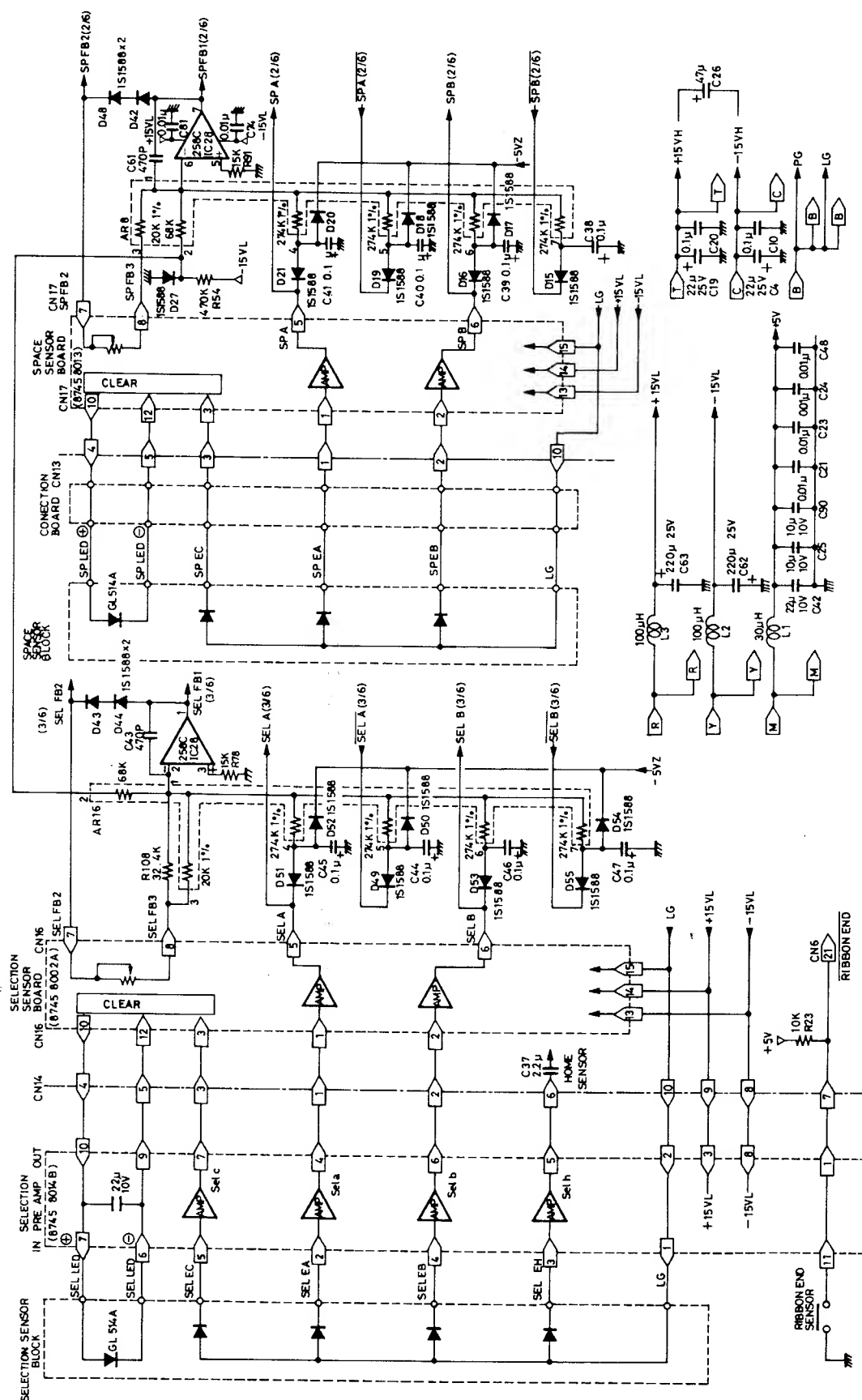
NOTE AR8.16.RESISTOR ARRAY

POWER BOARD LOGIC 2/6

POWER BOARD LOGIC 3/6

POWER BOARD LOGIC 5/6

CN7 SPM1 (Y)
CN7 SPM2 (R)
CN8 PG

CN9

15	HAM 1
14	HAM 2
13	SEL M2
12	SEL M2
11	SEL M1
10	SEL M1
9	RF M4
8	RF M3
7	RF M1
6	RF M2
5	GND
4	LIFT MG
3	L SHIFT MG
2	H SHIFT MG
1	+15VH

3	SP LC
2	+5V
1	SP HOME

CN11

10	+5V
9	+15VL
8	−15VL
7	GND
6	SP PT
5	SP A
4	SP B
3	SEL PT
2	SEL A
1	SEL B

CN12

4	LF M2
3	LF M1
2	LF M3
1	LF M4

CN13

10	GND
9	+15VL
8	+15VL
7	
6	
5	SP LED ⊖
4	SP LED ⊕
3	SP EC
2	SP EB
1	SP EA

CN14

10	GND
9	+15VL
8	−15VL
7	RIB END
6	sel h
5	SEL LED ⊖
4	SEL LED ⊕
3	sel c
2	sel b
1	sel a

CN15

CN6

45	LIFT HIGH			
43	LIFT HOLD	44	LF φA	
41	SHIFT HIGH	42	LF φB	
39	SHIFT LOWER	40	SP 1	
37	SP DRIVE	38	SP 2	
35	SP REVERSE	36	SP 3	
33	SP PT	34	SP HOME	
31	HAM DRIVE	32	SP CLOCK	
29	RESET	30	SEL & HAM 1	
27	SEL DRIVE	28	SEL & HAM 2	
25	SEL REVERSE	26	SEL & HAM 3	
23	SEL PT	24	SEL HOME	
21	RIBBON END	22	SEL CLOCK	
19	−15VL	20	RF φA	
17	−15VL	18	RF φB	
15	+15VL	16	RF DRIVE	
13	+15VL	14	SPO	
11	GND	12	SERVO HOLD	
9	GND	10	+5V	
7	GND	8	+5V	
5	GND	6	+5V	
3	GND	4	+5V	
1	GND	2	+5V	

CN17

15	GND
14	+15VL
13	−15VL
12	SP LED ⊖
11	
10	SP LED ⊕
9	
8	SP FB3
7	SP FB2
6	SP B
5	SP A
4	
3	SP EC
2	SP EB
1	SP EA

CN16

15	GND
14	+15VL
13	−15VL
12	SEL LED ⊖
11	
10	SEL LED ⊕
9	
8	SEL FB3
7	SEL FB2
6	SEL B
5	SEL A
4	
3	sel c
2	sel b
1	sel a

GND(B) +5V(M)
−15VH(C) +15VH(T)
+15VL(R) −15VL(Y)

−15VL −15VH +5V +15VL +15VH GND
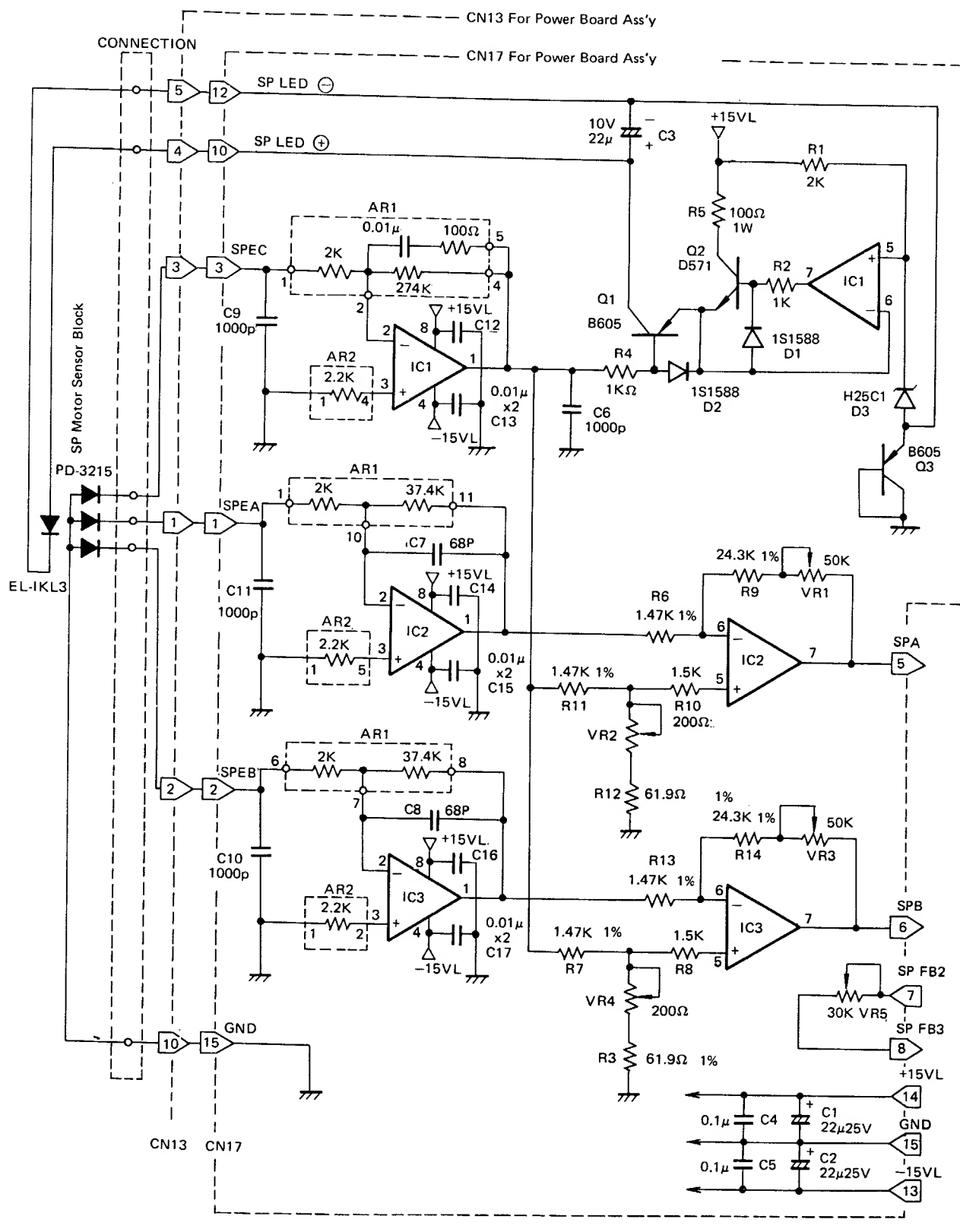(Y) (C) (M) (R) (T) (B)

(FG) LG (FG) CN15

SELECTION SENSOR BOARD/SELECTION PRE AMP BOARD LOGIC
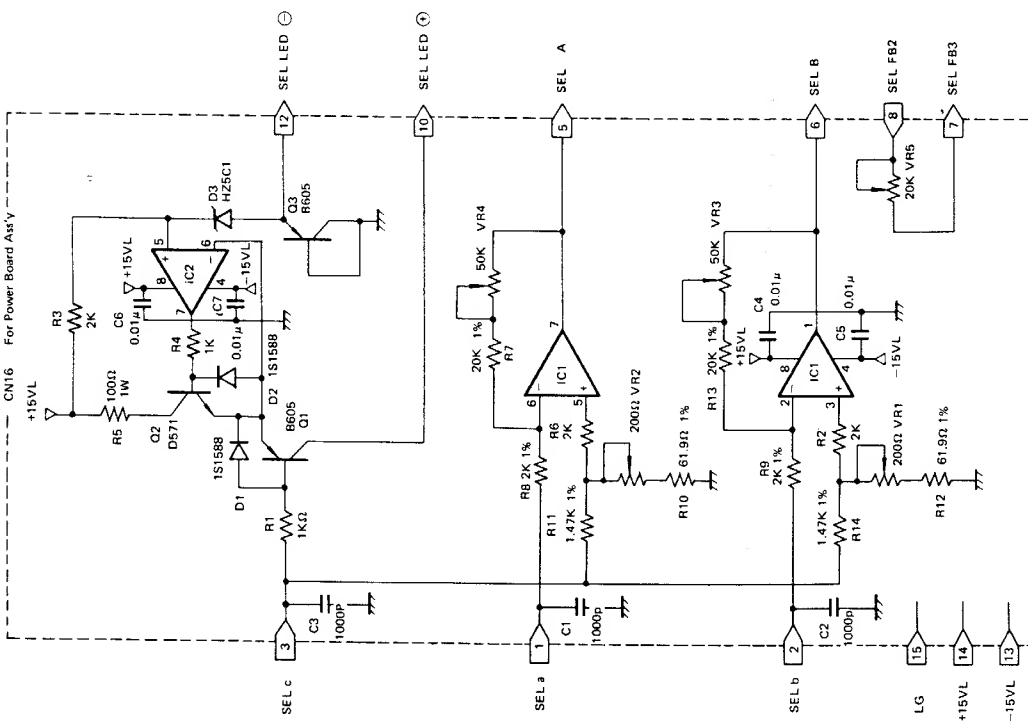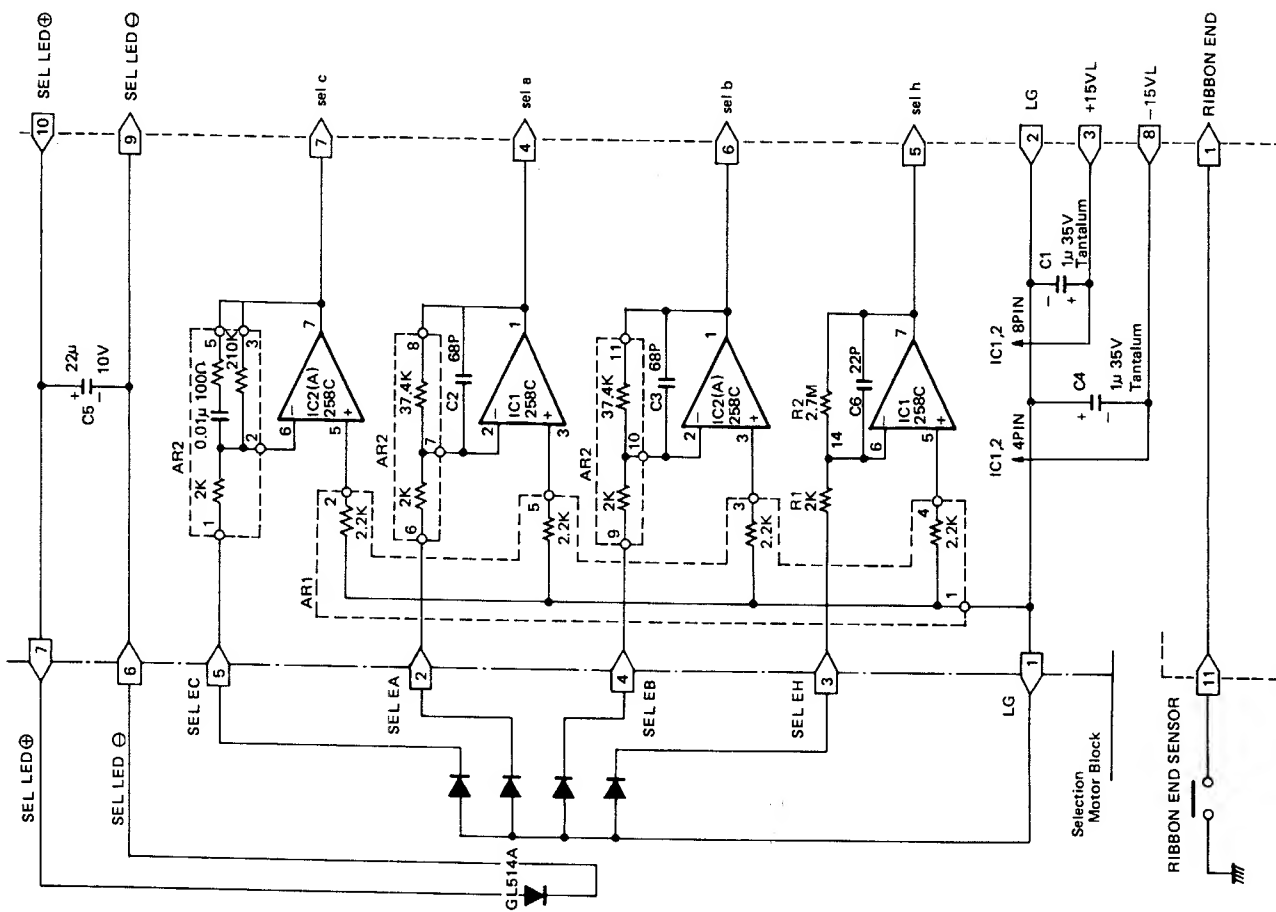
SPACE SENSOR BOARD LOGIC

POWER SUPPLY LOGIC (100/200 Volt Series)